BK PRECISION®

Instruction Manual

Model 2831C 3 1/2 Digit Bench Type Digital Multimeter

TEST INSTRUMENT SAFETY

WARNING

An electrical shock causing 10 milliamps of current to pass through the heart will stop most human heartbeats. Voltage as low as 35 volts dc or ac rms should be considered dangerous and hazardous since it can produce a fatal current under certain conditions. Higher voltages are even more dangerous.
Observe the following safety precautions:

1. Do not exceed the following input ratings. Personal injury or damage to the instrument may result.

DC VOLTS	(Range 2V~1kv) 1200 V (dc + ac peak)	DC VOLTS (Range 200mv) 750V (dc+ac pk)
AC VOLTS	(Range 2V~1kv) 1000 V rms	AC VOLTS (Range 200mv) 750V rms
OHMS	450 V dc or ac rms	
200μA – 2 A	2 A (fuse protected)	
20 A	20 A (unfused)	
COM	Do not float more than 500 volts from earth ground.	

2. Remove test leads from the instrument and point of measurement before replacing fuses or performing any servicing on the multimeter.
3. Use only shrouded safety type test leads like those supplied. Periodically inspect insulation for any burns, cuts, or breaks. Never use test leads with exposed bare wires or poor insulation.
4. Turn off equipment while making test connections in high-voltage circuits. Discharge high-voltage capacitors after removing power.
5. For voltage or current measurements in high voltage equipment, do not touch equipment, meter, or test leads while power is applied.
6. If possible, familiarize yourself with the equipment being tested and the location of its high voltage points. However, remember that high voltage may appear at unexpected points in defective equipment.
7. Use an insulated floor material or floor mat to stand on, and an insulated work bench surface; make certain such surfaces are not damp or wet.

(continued on inside back cover)

Instruction Manual
for
Model 2831C

Bench Type
3-1/2 Digit
MULTIMETER

B&K PRECISION®
22820 Savi Ranch Parkway, Yorba Linda CA 92887

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INTRODUCTION

The **B & K Precision** Model 2831C bench-type 3-1/2 digit multimeter is a highly versatile instrument offering standard functions of voltage, current (with a 20A range), and resistance measurements. In addition, it also includes diode test and continuity functions.

The instrument is easy to use, as all functions are selected from a panel of very logically laid out and identified pushbuttons. The 3-1/2 digit LED display features 0.43" digits with automatic minus sign and auto-zero capability.

The unit is housed in a rugged, attractive plastic case, and the carrying handle doubles as a sturdy tilt stand. The tilt stand can be folded on top of the instrument to allow stacking with your other instrument.

Safety features include safety jacks, safety test leads, and extensive overload protection, including a high energy fuse.

B & K Precision offers a full line of optional accessories for the Model 2831C which can further expand the capabilities and usefulness of the instrument. Please contact your local **B & K Precision** distributor or **B & K Precision** for more information on the latest accessories.

SPECIFICATIONS

All accuracies specified at 23°C ± 5 °C, 75% maximum relative humidity.

DC VOLTAGE

RANGE	MAXIMUM INDICATION	ACCURACY	MAX INPUT
200 mV	±199.9 mV	±(0.1% of reading + 1 count) All ranges	750V (dc+ac peak)
2 V	±1.999 V		1200V (dc+ac peak)
20 V	±19.99 V		
200 V	±199.9 V		
1200 V	±1200 V Max. Input		

Normal mode rejection: 50 dB minimum at 50/60 Hz.

Common mode rejection: 120 dB minimum at dc and 50/60 Hz with 1 kΩ unbalance.

Response time: 1 second.

Input Impedance: 10 MΩ.

AC VOLTAGE

TRUE RMS: FROM 10% to 100% OF RANGE

RANGE	MAXIMUM INDICATION	FREQENCY	ACCRACY	MAX. INPUT VOLTAGE
200 mV	199.9 mV	40 Hz to 1 KHz 1 KHz to 10 KHz 10 KHz to 20 KHz 20 KHz to 40 KHz	±(0.5% of rdg+4cnts) ±(2% of rdg+4cnts) ±(5% of rdg+4cnts) ±(10% of rdg+4cnts)	750 V rms
2 V	1.999V	40 Hz to 1 KHz 1 KHz to 10 KHz 10 KHz to 20 KHz 20 KHz to 40 KHz	±(0.5% of rdg+4cnts) ±(2% of rdg+4cnts) ±(5% of rdg+4cnts) ±(10% of rdg+4cnts)	1000 V rms
20 V	19.99V	40 Hz to 1 KHz 1 KHz to 10 KHz 10 KHz to 20 KHz 20 KHz to 40 KHz	±(0.5% of rdg+4cnts) ±(2% of rdg+4cnts) ±(5% of rdg+4cnts) ±(10% of rdg+4cnts)	
200 V	199.9V	40 Hz to 1 KHz 1 KHz to 10 KHz	±(0.5% of rdg+4cnts) ±(2% of rdg+4cnts)	
1000 V	1000 V Max. Input	40 Hz to 1 KHz	±(0.5% of rdg+4cnts)	

*Not to exceed the Volt-Hertz product of 10^7.

Input impedance: 10 MΩ in parallel with 100 pF.
Common mode rejection: 60 dB minimum at 50/60 Hz.
Response time: 3 seconds maximum.

DC CURRENT

RANGE	MAXIMUM INDICATION	ACCURACY	MAXIMUM INPUT
200 µA	±199.9 µA	±(0.2% of reading + 1 count)	2 A
2 mA	±1.999 mA		
20 mA	±19.99 mA		
200 mA	±199.9 mA		
2000 mA	±1999 mA	±(0.3% of reading + 1 count)	
20 A	±19.99 A		20A through 20 A input jack

Maximum burden voltage (with supplied test leads): 0.3 V at 200 mA. 1 V at 2000 mA. 2.5 V (0.25 V across 20A jacks) at 20 A.

Response time: 1 second.

Overload protection: 2 A/250 V fuse in series on mA input jack. 20 A range unfused.

AC CURRENT

TRUE RMS: FROM 10% to 100% OF RANGE

RANGE	MAXIMUM INDICATION	FREQUENCY	ACCURACY	MAXIMUM INPUT
200 µA	199.9 µA	40Hz to 10KHz 10KHz to 20KHz	±(1% of rdg+4cnts) ±(2% of rdg+4cnts)	2 A
2 mA	1.999 mA	40Hz to 10KHz 10KHz to 20KHz	±(1% of rdg+4cnts) ±(2% of rdg+4cnts)	
20 mA	19.99 mA	40Hz to 10KHz 10KHz to 20KHz	±(1% of rdg+4cnts) ±(2% of rdg+4cnts)	
200 mA	199.9 mA	40Hz to 10KHz 10KHz to 20KHz	±(1% of rdg+4cnts) ±(2% of rdg+4cnts)	
2000 mA	1999mA	40Hz to 2KHz	±(1% of rdg+4cnts)	
20 A	19.99 A	40Hz to 2KHz	±(1% of rdg+4cnts)	20 A through 20A input jack

Maximum burden voltage (with supplied test leads): 0.3 V at 200 mA. 1 V at 2000 mA. 2.5 V (0.25 V across 20A jacks) at 20 A.

Response time: 3 second.

Overload protection: 2 A/250 V fuse in series on mA input jack. 20 A range unfused.

SPECIFICATIONS

RESISTANCE

RANGE	MAXIMUM INDICATION	ACCURACY	TEST CURRENT	OVERLOAD PROTECTION
200 Ω	199.9 Ω	± (0.2% of rdg+2cnts)	4.2 mA	450 V dc/ac rms All ranges
2 KΩ	1.999 KΩ	±(0.2% of rdg+1cnt)	420 μA	
20 KΩ	19.99 KΩ		42 μA	
200 KΩ	199.9 KΩ		4.2 μA	
2000 KΩ	1999 KΩ		0.42 μA	
20 MΩ	19.99 MΩ	± (0.5% of rdg+1cnts)	0.042 μA	

Open circuit volage: 5 V maximum loaded with 10 M Ω

Response time: 3 second (20 seconds on 20 MΩ range)

DIODE TEST

Tested on 2 KΩ range. 1 mA test current.

CONTINUITY

Audio tone sounds when resistance is less than 10 ohms typical.

GENERAL SPECIFICATIONS

Temperature range:

Operating: 0℃ to +40℃.

Storage: −20℃ to +60℃.

Humidity range: 90% maximum to +35℃. except 80% maximum on 2000 k Ω and 20 M Ω range. 70% maximum to +40℃ (non-condensing).

Maximum common mode voltage: 500 V.

Display: LED, 0.43" character height.

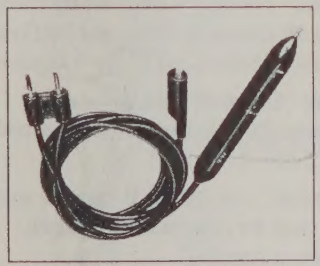
Power requirements: 100/120/220/240 V, 50/60 Hz, 5 W.

Dimeensions (W×H×D): 261 × 71 × 211 mm (10.27 × 2.79 × 8.3) in

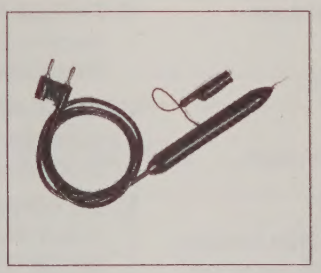
Weight: 1.63 Kg (3.6 lbs).

Accessories supplied: Test leads (2)
Instruction manual (1)
Spare 2 A fuse (2)

OPTIONAL ACCESSORIES

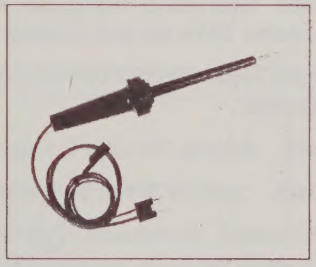


Model PR-21
Isolation/Direct Probe



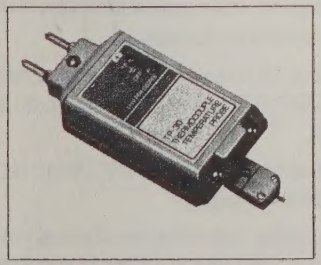
Model PR-23
Demodulator Probe

Additional Accessories:
TL-2A Replacement Test Leads



Model PR-28A
High-voltage Probe

See your local
B & K Precision distributor
for more details.



Model TP-30B
Temperature Probe

CONTROLS AND INDICATORS

1. **V-Ω Jack** Input jack for voltage measurement, resistance measurement. Diode test, and continuity test.
2. **COMmon Jack.** Input for common test lead for all measurements.
3. **mA Jack.** Input for 200 μA to 2 A dc or ac current ranges.
4. **20 A Jack.** Input for 20 amp dc or ac current range.
5. **AC/DC Switch.** Selects ac or dc in voltage and current functions. Engage switch (set to "in" position) for ac; disengage (set to "out" position) for dc.
6. **V Switch.** Selects voltage function.
7. **A (amp) Switch.** Selects current function.
8. ⊣⊢ •)) **Ω Switch.** Selects diode test function, resistance functions, and continuity test function. When both 200 Ω and 2 K resistance function are selected, this switch enables audible continuity test. Continuity tone is enabled when switches are engaged.
9. **200 mV/200 μA/200 Ω/** ⊣⊢ •)) **Switch.** Selects 200 mV range for ac/dc voltage functions, 200μA range for ac/dc current functions, and 200 Ω range for resistance function. Enables continuity test in conjunction with switch (8) and (10).
10. **2 V/2 mA KΩ/** ⊣⊢ **Switch.** Selects 2 V range for ac/dc voltage functions. 2 mA range for ac/dc current functions, and 2 KΩ range for resistance function. Also selects diode test (⊣⊢) function.
11. **20 V/20 mA/20 KΩ Switch.** Selects 20 V range for ac/dc voltage functions. 20 mA range for ac/dc current functions, and 20 KΩ range for resistance function.
12. **200 V/200 mA/200 KΩ Switch.** Selects 200 V range for ac/dc voltage functions. 200 mA range for ac/dc current functions, and 200 KΩ range for resistance function.
13. **1200 VDC/1000 VAC/2000 mA/2000 KΩ Switch.** Selects 1200 V range for dc voltage function, 1000 V range for ac voltage function, 2000 mA (2 A) range for ac/dc current functions, and 2000 KΩ (2 MΩ) range for resistance function.
14. **20 A/20 MΩ Switch.** Selects 20A range for ac/dc current functions. Used in conjunction with 20 A jack (4). Also selects 20 MΩ range for resistance function.
15. **POWER Switch.** Turns instrument ON and OFF. Power-on indicated by presence of characters on display.
16. **Display.** 3-1/2 digit LED display with automatic decimal point and minus (-) sign. Indicates to 1999 counts. Over range indicated by a "1" displayed at the leftmost digit while all other digits remain blank

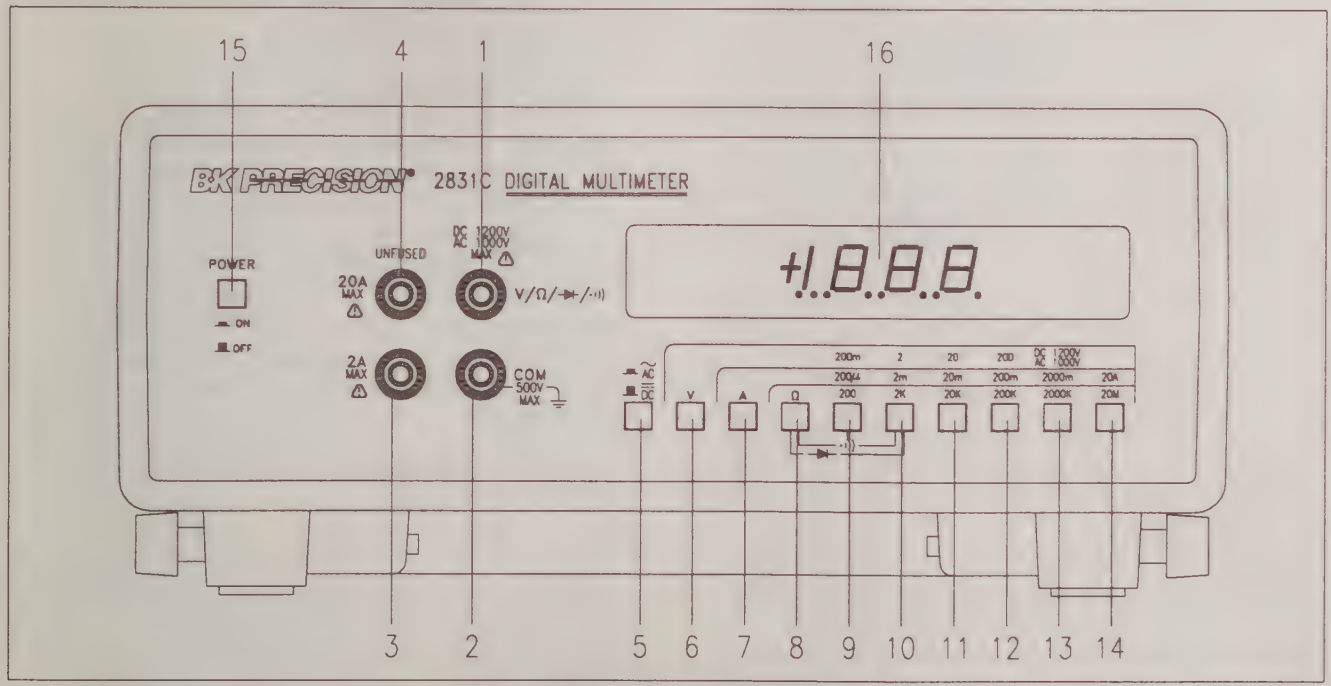


Fig. 1. Controls and indicators

OPERATING INSTRUCTIONS

WARNING

Use of test equipment may expose the operator to electric shock hazards. Observe all instructions contained in the TEST INSTRUMENT SAFETY section of this manual Before using this instrument.

CAUTION

The TEST INSTRUMENT SAFETY section of this manual lists maximum voltage and current input limits which must be observed. Failure to adhere to these limits may result in damage to the instrument.

PRELIMINARY

Plug the unit into an ac outlet of the appropriate voltage and turn it on by depressing the POWER switch.

VOLTAGE MEASUREMENTS

1. Press the V function switch.
2. Select ac or dc measurement using the **AC/DC** switch. Set for dc measurement by setting switch to disengaged ("out ") position. Push switch "in" for ac measurement.
3. If the voltage to be measured is unknown, start with the 1200 VDC/1000 VAC range.
4. If an approximate voltage range is known, simply press the switch for the range desired. Greatest resolution is attained using the range closest to an over range for the voltage being measured.
5. Connect the red test lead to the **V-Ω** jack and the black test lead to the **COM** jack.
6. Connect the test leads across the circuit points to be measured.
7. Read the measured value from the display.

CURRENT MEASUREMENTS

CAUTION

For current measurements, the meter must be connected ***in series*** *with the load. If incorrectly connected (in parallel with the load), the meter presents a very low impedance (almost a short), which may blow the fuse or damage the meter or equipment under test. The 20 A range has on fuse protection and may severely damage the meter or equipment under test or cause personal injury.*

For current measurements greater than 2 A, high current test leads should be used. High current measurements with standard test leads could cause the leads to heat up. This not only affects the accuracy of the measurement, but could result in injury to the operator.

1. Press the **A** function switch.
2. Select ac or dc measurement using the **AC/DC** switch. Set for dc measurement by setting switch to "out" position. Push switch "in" for ac measurement.
3. If the current to be measured is unknown, start with the meter in the **20 A** range, using the **20 A** jack. If the expected current might exceed 2 A, use high current test leads.
4. If an approximate current range is known, simply press the switch for the range desired. Greatest resolution is attained using the range closest to an overrange for the current being measured.
   a. For current measurements of 2 A or less, connect the red test lead to the **2 A** jack and the black test lead to the **COM** jack.
   b. For current measurements greater than 2 A, connect a red *high current* test lead to the **20 A** jack and connect a black *high current* test lead to the **COM** jack.
5. Remove power from the circuit under measurement and open the normal circuit path where the measurement is to be taken. Connect the meter *in series* with the circuit.
6. Apply power to the circuit and read the measured value on the display.

RESISTANCE MEASUREMENTS

1. Remove power from the equipment under test.
2. Press the Ω function switch.
3. Connect the red test lead to the **V -Ω** jack and black test lead to the **COM** jack. The red lead is (+) polarity.
4. Connect the test leads to the desired point of measurement and observe the reading on the display.
5. If the expected resistance range is unknown, start with the lowest range. If an overrange is indicated, continue selecting higher ranges until the overrange indication ceases. At this range, greatest resolution is achieved.

CONTINUITY TESTING

1. Remove power from the equipment under test.
2. Press the Ω switch.
3. Select both 200 Ω and 2 KΩ resistance ranges (press both 200 and 2 K switches simultaneously).
4. Connect the red test lead to the **V -Ω** jack and the black test lead to the **COM** jack. The red lead is (+) polarity.
5. Connect the test leads to the desired measurement points.
6. If the resistance between the two points is less than 10 ohms (typical), the continuity tone will sound.
7. Disengaging one of the two switches (200 Ω and 2 KΩ switch at "out" position) will disable the continuity tone. The instrument will then be operating in standard ohms mode.

DIODE TESTING

1. Press the Ω switch.
2. Press the 2 K switch.
3. Connect the red test lead to the **V -Ω** jack and the black test lead to the **COM** jack. The red lead is (+) polarity. The meter uses conventional-current lead polarity for diode testing (i.e. current flow assumed from positive-to-negative).
4. To check diode forward voltage (V_f), connect the red test lead to the anode and the black test lead to the cathode. Diodes and semiconductor junctions with normal V_f of less than 2.0 V can be checked.
5. The display indicates diode forward voltage. Normal diode voltages are approximately 0.3 V for germanium diodes, 0.6 V for silicon devices, and 1.6 V for light emitting diode (LED's). An overrange indicates an open diode. A shorted diode reads near 0 V.
6. To check the reverse-bias condition of a diode, reverse the test lead connections to the device. The reading should be the same as with open test leads (an overrange). A lower reading indicates a leakydiode.

MAINTENANCE

WARNING

The following instructions are for use by qualified service personnel only. To avoid electrical shock, do not perform servicing other than contained in the operating instructions unless you are qualified to do so.

Remember that ac line voltage is present on line voltage input circuits any time the instrument is plugged into an ac outlet, even if turned off. Always unplug the unit before performing servicing procedures.

FUSE REPLACEMENT

There are two fuses in the unit — one for the mA current range and one for the main power supply. If your unit continues to operate (digits lit) but fails to measure current, check the two current fuses.

Current Range Fuse

Note: The fuse most likely to open first can be inspected and changed without case removal. It is located on the rear panel of the unit. Simply use a flat blade screwdriver to rotate the terminal counterclockwise.

Then remove the entire assembly, including the fuse. If this fuse is blown, replace it with the appropriate 2 A,250 V, 5 × 20 mm fast-blow fuse (Part number 196-300-2-000). Then replace the fuseholder.

Power Supply Fuse

If your unit does not operate at all (no digits lit), check power supply fuse (See Fig. 2) . Note: This fuse should not open unless some defect occurs in the instrument. Replace it only after investigation of the reason for its opening. Use the appropriate value: 0.25 A, 250 V, fast-blow (part number 196-300-0-250) for 100/120V operation, or 125 mA, 250 V, fast-blow (part number 196-300-0-125) for 220/240 V operation.

LINE VOLTAGE SELECTION

This instrument is the universal line operation: 100V, 120V, 220V and 240V. The below is explaining the user how to charge fuse.

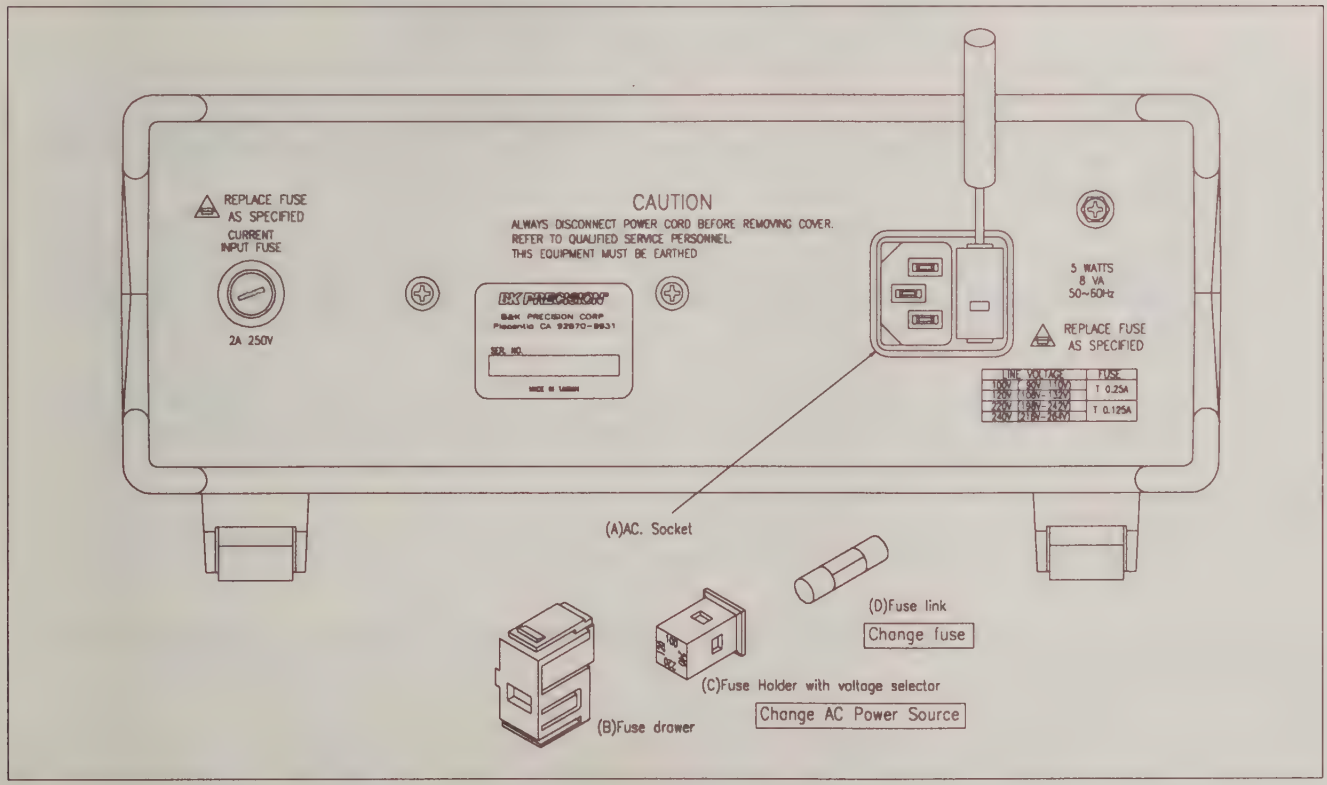
1. Extract the fuse drawer from the AC socket with the aid of a screwdrive (The extra safe fuse drawer can only be extracted with the aid of a flat blade screwdriver.)
2. Pull out the fuse from the fuse holder and charge the fuse rating in accordance with specific required.
3. Plugging fuse holder into the Line voltage indication shown on the fuse drawer is correct. Rotating the fuse holder before insert fuse drawer to have correct voltage indication.
4. Install the fuse drawer into AC sollect.

TEST LEADS

Periodically examine the test leads to ensure that the conductors are not intermittent or broken.. Also make sure that good contact pressure exists at the test lead receptacles. Keep these areas free from dirt and corrosion. Use shrouded safety type replacement test leads.

INSTRUMENT REPAIR SERVICE

Because of the specialized skills and test equipment required for instrument repair and calibration, many customers prefer to rely upon **B & K Precision** for this service. We maintain a network of **B & K Precision** authorized service agencies for this purpose. To use this service, even if the instrument is no longer under warranty, follow the instructions given in the WARRANTY SERVICE INSTRUCTIONS section of this manual. There is a nominal charge for instruments out of warranty.


REPLACE FUSE
AS SPECIFIED
CURRENT
INPUT FUSE
2A 250V
CAUTION
ALWAYS DISCONNECT POWER CORD BEFORE REMOVING COVER.
REFER TO QUALIFIED SERVICE PERSONNEL.
THIS EQUIPMENT MUST BE EARTHED
B&K PRECISION
B&K PRECISION CORP
Placentia CA 92870-9831
SER. NO.
MADE IN TAIWAN
5 WATTS
8 VA
50~60Hz
REPLACE FUSE
AS SPECIFIED
LINE VOLTAGE
FUSE
100V (90V~110V)
T 0.25A
120V (108V~132V)
220V (198V~242V)
T 0.125A
240V (216V~264V)
(A)AC. Socket
(D)Fuse link
Change fuse
(C)Fuse Holder with voltage selector
Change AC Power Source
(B)Fuse drawer

WARRANTY SERVICE INSTRUCTIONS

Warranty Service: Please return the product in the original packaging with proof of purchase to the below address. Clearly state in writing the performance problem and return any leads, connectors and accessories that you are using with the device. Contact B&K Precision to obtain a **Return Authorization** number before shipping the product to **B&K. The RA number must appear on the address label.**

Non-Warranty Service: Return the product in the original packaging to the below address. Clearly state in writing the performance problem and return any leads, connectors and accessories that you are using with the device. Customers not on open account must include payment in the form of a money order or credit card. For the most current repair charges contact the factory before shipping the product. Contact **B&K Precision** to obtain a **Return Authorization** number before shipping the product to **B&K. The RA number must appear on the address label.**

Return all merchandise to **B&K Precision** Corp. with pre-paid shipping. The flat-rate repair charge includes return shipping to locations in North America. For overnight shipments and non-North America shipping fees contact **B&K Precision** Corp.

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Yorba Linda, CA 92887
www.bkprecision.com

Phone: 714-921-9095
Facsimile: 714-921-6422
Email: service@bkprecision.com

Include with the instrument your complete return shipping address, contact name, phone number and description of problem.

LIMITED ONE-YEAR WARRANTY

B&K Precision Corp. warrants to the original purchaser that its product and the component parts thereof, will be free from defects in workmanship and materials for a period of one year from the date of purchase.

B&K Precision Corp. will without charge, repair or replace, at its' option, defective product or component parts. Returned product must be accompanied by proof of the purchase date in the form a sales receipt.

To obtain warranty coverage in the U.S.A., this product must be registered by completing and mailing the enclosed warranty card to **B&K Precision** Corp., 22820 Savi Ranch Parkway, Yorba Linda, CA 92887 within fifteen (15) days from proof of purchase.

Exclusions: This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alternations or repairs. It is void if the serial number is alternated, defaced or removed.

B&K Precision Corp. shall not be liable for any consequential damages, including without limitation damages resulting from loss of use. Some states do not allow limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific rights and you may have other rights, which vary from state-to-state.

(continued from inside front cover)

8. Keep "one hand in the pocket" while handing an instrument probe. Be particularly careful to avoid contacting a nearby metal object that could provide a good ground return path.
9. When using a probe, touch only the insulated portion. Never touch the exposed tip portion.
10. Some equipment with a two-wire ac power cord, including some with polarized power plugs, is the "hot chassis" type. This includes most recent television receivers and audio equipment. A plastic or wooden cabinet insulates the chassis to protect the customer. When the cabinet is removed for servicing, a serious shock hazard exists if the chassis is touched. Not only does this present a dangerous shock hazard, but damage to test instruments or the equipment under test may result. To make measurements in "hot chassis" equipment, always connect an isolation transformer between the ac outlet and the equipment under test. The **B & K Precision** Model TR-110 or 1604 Isolation Transformer, or Model 1653 or 1655AC Power Supply is suitable for most applications. To be on the safe side, treat all two-wire ac powered equipment as "hot chassis" unless you are sure it has an isolated chassis or an earth ground chassis.
11. **B & K Precision** products are not authorized for use in any application involving direct contact between our product and the human body, or for use as a critical component in a life support device or system. Here, "direct contact" refers to any connection from or to our equipment via any cabling or switching means. A "critical component of a life support device or system whose failure to perform can be reasonably expected to cause failure of that device or system, or to affect its safety or effectiveness.
12. When testing ac powered equipment, remember that ac line voltage is usually present on some power input circuits such as on-off switch, fuses, power transformer, etc. any time the equipment is connected to an ac outlet, even if the equipment is turned off.
13. Never work alone. Someone should be nearby to render aid if necessary. Training in CPR (cardio-pulmonary resuscitation) first aid is highly recommended.

B&K PRECISION®

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